ARI Newsletter

Future Staff Training

An integrated picture of the battle space will require future staff who are technical and multifunctional decision makers.

"Digitization," the introduction of digital technology into the Army, will change more than how the Army communicates; it has the potential to change staff organization, roles, functions, even the way staffs think and make decisions.

Many tasks that staffs perform now will become automated, so future staffs can be smaller. Many functions now requiring extensive technical training will be computerized, allowing future staff officers to be more "generalist" and multi-functional. With complete, accurate and timely information on friendly and enemy forces, combined with computerized decision-aids, commanders and staffs will have the ability to form a much more integrated picture of the battlespace than is now possible.

Communicate Quickly

This rich information environment of digital staffs will facilitate better, faster decision making. The ability to communicate information quickly and accurately will be improved as well, enabling commanders and staffs to quickly change plans based on changes in the tactical situation, and quickly translate plans into action. All these changes will require new training techniques.

IN THIS ISSUE

From the Director

The cumulative building of data and findings into useful technology is the heart of the research process. Applied research is the leading edge of the process, solving real world problems and meeting the challenges of a transforming Army. The central issue for the applied researcher is the definition of the problem in operational terms; ensuring that the research effort is defined from a perspective where the result will meet Army needs. If the Army can't use products of the research knowledge gained, then we have done a poor job of problem definition. The issue of problem definition is actually the issue of research utilization, one of the fundamental criteria used to evaluate applied research. In this issue of the *ARI Newsletter*, each of the efforts reported builds upon previous research and knowledge. Each effort also defines its research issue in operational terms. You, the reader are the assessors of our success and I invite you to correspond with the authors of these articles to make your assessments known.

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Future Staff Training

Continued from page 1
In partnership with the Mounted Maneuver Battlespace Lab (MMBL) at Fort Knox, Kentucky, the U.S. Army Research Institute (ARI) developed training to make the decision-making of future staffs fit their environment. We applied this training in a futuristic simulation environment, in the context of a series of MMBL experiments called Battle Command Re-engineering (BCR).

The BCR experiments introduced new simulated command, control, communication, and computer (SC4) tools, a new staff organization, and new multi-functional roles for battalion staffs of 2010. The BCR environment is illustrated in Figure 1.
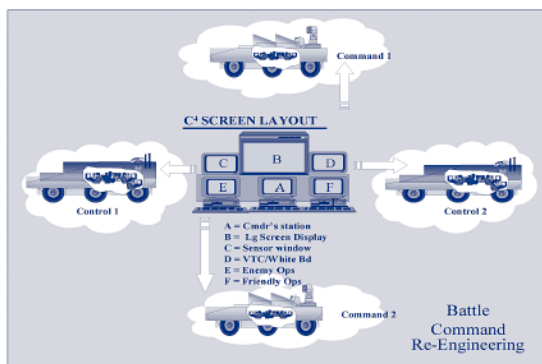

Figure 1: The BCR Environment

The SC4 tools presented a picture that was both fused and common. The picture was fused in that mission, enemy, terrain, own troops and time (METT-T) elements were presented on one system, rather than on separate ones for each battlefield operating system (BOS). The picture was common in that all staff members had access to the same tools and therefore the same fused picture. The tools included the ability to conduct a collaborative whiteboard video-teleconference with all staff members and subordinate commanders, in order to develop, issue, refine or rehearse orders.

New Staff Organization
The BCRs also introduced a new battalion staff organization. Unlike a current battalion staff consisting of around 50 soldiers, this new organization used four dispersed nodes consisting of only 14 soldiers. Command 1 contained the battalion commander, while Command 2 contained the deputy commander. Control 1 and 2 each alternated between current operations and future planning. For instance, Control 1 would plan a future operation, then execute it as current operations in a subsequent exercise, while Control 2, which had been serving as current operations, would conduct future planning in the subsequent exercise.

Future decision-making must be made faster by fitting the future decision-making process to the future environment. The current Military Decision Making Process (MDMP) has three basic features. First, multiple (usually three) courses of action (COAs) are developed. Second, these COAs are compared by assessing them (assigning a score) on a series of weighted attributes. Then third, the COA with the best score is selected.

Natural Decisions
A decision-making process more suited to the future decision-making environment is based on naturalistic decision-making (NDM) theory. One version of NDM theory, developed by Klein under contract to ARI, is called the recognition-primed decision (RPD) model.

The NDM is a model used by experts (individuals or teams) to make decisions. Expert teams approach a situation based on their past experiences. They unconsciously integrate the cues in a situation and recognize a pattern fitting their past experiences in similar situations. A COA becomes immediately apparent, based on what worked in similar situations in the past. Experts then mentally simulate the COA. If the COA works well, they execute it.

Future Staff Training

Continued from previous page

If the COA has flaws, but is still workable, they refine it, and mentally simulate the revised COA. If it is unworkable, they form a new integrated representation of the situation and new COA.

The RPD model is illustrated in Figure 2. In the RPD model, multiple COAs are developed consecutively, not concurrently. Furthermore, the decision makers are always ready to accept and implement a COA that appears to be satisfactory. Since 1) COA generation is rapid and based on experience, 2) only one COA is generally required, and 3) a candidate COA can be quickly accepted, the RPD process has the potential to be considerably faster than the MDMP, enabling decision-makers to act inside the enemy's decision cycle.
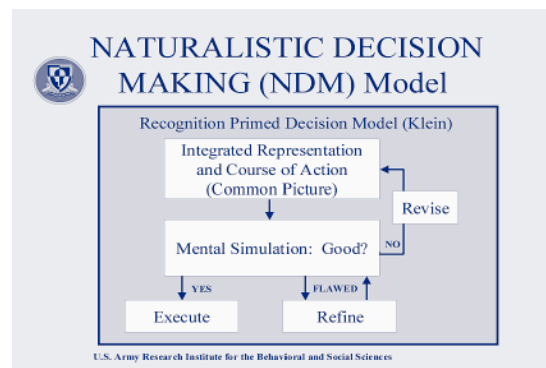

Figure 2: Klein's RPD Model

New training was developed and delivered in conjunction with three Tactical Decision Exercises (TDXs). These TDXs were structured scenarios requiring the staff to make decisions in this futuristic environment. There were three TDXs: (1) course of action development and rehearsal; (2) battalion fragmentary order (FRAGO, or a change in the operations order); and (3) brigade FRAGO. The new training consisted of two preliminary exercises and three team training sessions (TTS).

Roles & Functions

The two exercises were particularly appropriate to the Battle Command Re-Engineering (BCR) environment, with its new organization, roles, and information-age technology. They were called the Roles and Functions Exercise and the Information Management Exercise.

The Roles and Functions Exercise was held prior to the first Tactical Decision Exercise TDX). Each member of the staff, from most junior to commander, stated his role, to whom he reported and who reported to him, the key tasks performed, where (from whom) information to perform the task was obtained and where (to whom) the information from the task went. This helped participants to develop a common picture of the staff's roles and functions, and how they were accomplished. This common picture could help staff members anticipate other's needs and "push" information or action to staff members.

Info Management

The Information Management Exercise was held after the Roles and Functions Exercise and also before the first TDX. Staff members were presented with a scenario demonstrating a need for a naming convention for files such as draft operations overlays (orders). Then the staff held a working session to develop a naming convention, with example conventions provided.

The three TTS were embedded into the TDXs. They were designed to occur before execution, during execution, and after each TDX. The three TTS were Pre-Execution Brief, Situation Update, and Team Decision-Making Debrief. They were all based on NDM theory and other tactical decision making (TDM) team training research.

Future Staff Training

Continued from previous page

The Pre-Execution Brief TTS was to be held before the execution phase of the TDX. The session was held after the staff had some time to review the brigade order and the commander's battlefield visualization; his view of the current tactical situation, desired end-state and plans for achieving that end-state. Each of the node officers in charge (OIC) discussed the node's role and functions during the exercise.

Show Stopper

Finally, each staff member listed one challenge or "show stopper" that could occur during the exercise. The staff discussed ways to deal with the challenges presented. Thus, paralleling the RPD model, the commander presented his integrated representation of the situation and COA, the node OICs mentally simulated their nodes' roles and functions during the exercise, and the staff members helped refine the COA based on their identification of challenges to the plan.

Further, by discussing the COA and each node's roles and functions during the TDX as a team, the staff could develop a common picture of what they would be doing. This could aid members in knowing what information and action they would have to provide to various other staff members during the exercise.

The Situation Update TTS occurred during execution at a point of uncertainty caused either by conditions of the situation or the staff. The Commander described his immediate goals (integrated representation and COA), what should occur in 30 to 60 minutes (mental simulation), his biggest concern (possible refinement of plan), and what information was needed (providing team members the ability to anticipate, and push information).

Common Picture

Again, this entire TTS could provide the staff with a common picture of the situation and what actions were necessary. The version of Situation Update TTS discussed above was called the commander's time-out. In another version, called the staff huddle, each node OIC answered the same four questions based on his specific position.

The Team Decision Making Debrief TTS occurred after each TDX. Each node OIC discussed a difficult decision made during the exercise (integrated representation and COA), what information was needed (mental simulation), and what information was not available (refinement of plan). The OIC indicated to whom the decision was transmitted and any feedback received (refinement of plan).

The three TTS were implemented during the third and fourth BCRs, held during April of 1999 and 2000 at the MMBL at Fort Knox. Results showed that staff members found the TTSs useful. Participants also helped develop improvements to the TTSs.

Summary

The information and decision environments in which future staffs will operate will be different from that of current staffs. The Army needs to prepare by examining alternative decision making models such as NDM. We have developed prototype training to aid staffs in decision making in the future environment.

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RWARU's Role in Preparing Aviation Units for Deployment

Providing a commander's evaluation exercise tool, using collective team simulation training and interaction.

Networked Simulation

Being able to train and adapt that training to any geographical area has been the key to the successful employment of Army aviation assets. The use of networked training systems has great potential to enhance significantly the capability of Army aviation units to carry out complex missions in unfamiliar environments, while greatly reducing the costs and hazards associated with flying large numbers of aircraft. Over the last few years a series of exercises were carried out at Fort Rucker employing a number of simulation assets at the U.S. Army Aviation Center (USAAVNC). Among the tools employed to execute these simulated missions was the Army Research Institute's (ARI) OH-58D, Kiowa Warrior simulator. This simulator represents the flight characteristics and mission package of the Kiowa Warrior aircraft, shown in Figure 1. Located at the Rotary-Wing Aviation Research Unit (RWARU) at Fort Rucker, this device was built at RWARU out of parts from a cockpit procedures trainer, which was destined for disposal.

ARI obtained the device, added a visual image generator, displays, a host computer, and on-board tactical displays. In addition, the capability to interface with Distributed Interactive Simulation (DIS) network was installed. The device was initially used by ARI in support of the PM Kiowa Warrior to define the requirements for a gunnery trainer for the OH-58D. ARI's simulator is illustrated in Figures 2, 3, and 4.

Figure 1: OH-58D Kiowa Warrior

Figure 2: RWARU's OH-58D - Crewstation

Figure 3: RWARU's OH-58D Simulator - Cockpit Shell

The primary purpose of the most recent series of exercises was to support aviation units in preparation for their deployment to Bosnia. This was successfully accomplished. All USAAVNC and unit exercise objectives were met, and ten aviation mission critical tasks were exercised during the training. These Aviation Training Exercises (ATX) allowed the task force leaders to deal with changing variables and diverse missions, in an environment as close to the real world as possible. These mission rehearsals allow for interaction between pilots and ground forces. Through the use of simulation, aviators were able to respond during missions as though they were flying over Bosnia.

By participating in the ATX, ARI was able to observe first hand the nature of tasks critical to a deploying FORSCOM task force. It is hard to find a FORSCOM unit available for observation due to the very nature of an increased

RWARU's Role in Preparing Aviation Units for Deployment

Figure 4: RWARU's OH-58D Simulator - View Over Pilot's Shoulder

Continued from previous page

mission OPTEMPO. The focus of ARI has been on training issues and simulation research. ARI developed a one-of-a-kind Kiowa Warrior cockpit to look at issues with training and gunnery. ARI was able to provide this OH-58D simulator, which allowed the OH-58D crews from the aviation units to perform their missions in a cockpit that matched their aircraft. A Local Area Network (LAN) was put in place to connect the Army Research Institute (ARI), the Aviation Testbed, and the Warfighting Simulation center (Figure 5). This provided seven reconfigurable simulators from the Aviation Testbed (AVTB) and three reconfigurable simulators from the Aviation Combined Arms Tactical Trainer (AVCATT). These generic cockpits were configured to replicate AH-64D, OH-58D, and UH-60A rotary wing aircraft depending on the mission requirements. They were able to organize, plan, and execute joint missions along side the ARI OH-58D simulator. These missions were conducted using a common database, which placed all of the players in a virtual Bosnia.

Mission

The most recent exercise, ATX VII was held 21 October - 1 November 1999. It was a composite group of Active duty, National Guard and Reserve units. The units participating included
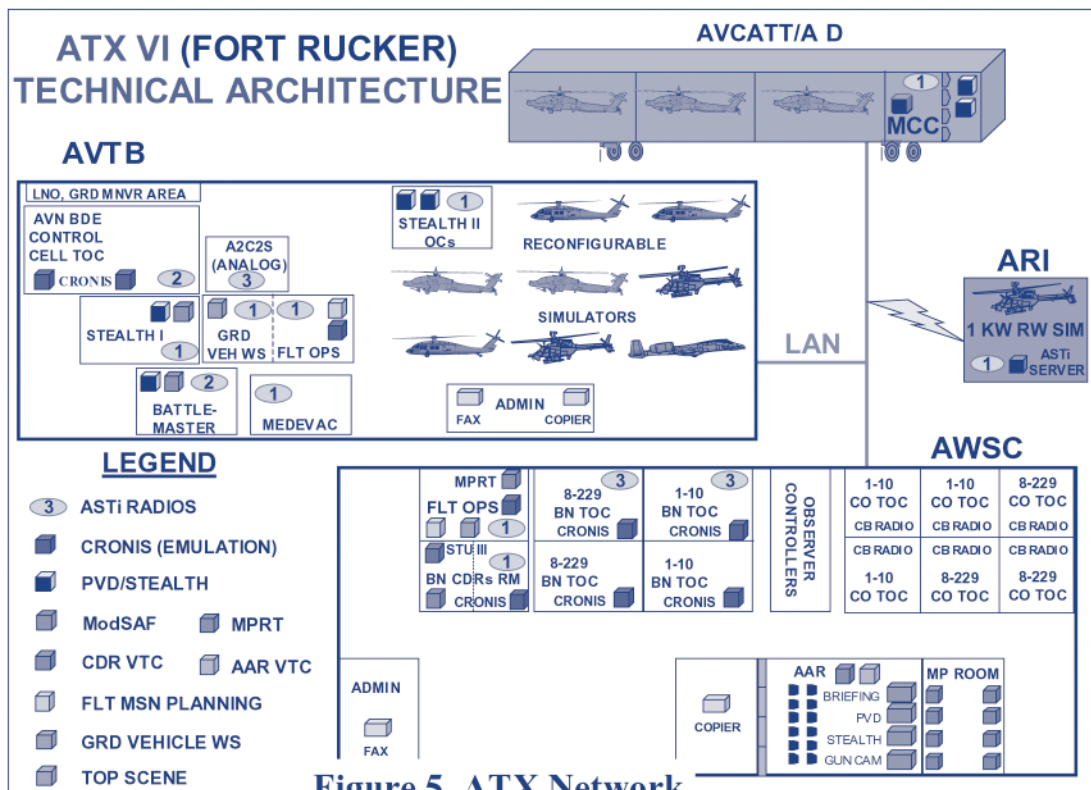
Figure 5. ATX Network

RWARU's Role in Preparing Aviation Units for Deployment

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members of the 49th Aviation Brigade, 49th Army Reserve Division Texas Army National Guard; 4th Squadron, 3rd Armored Cavalry regiment, Fort Carson, Colorado; and the 1042d Medevac Company, Oregon National Guard. In performing the weeklong exercise, the units were able to run a 24-hour cycle, which replicated the environment they will operate in while in Bosnia. The nature and importance of the missions increased as the week progressed. The intelligence gathered with each flight and ground reconnaissance pieced together a picture of unrest and possible conflict if ignored by military and civilian authorities. Some of the other themes simulated during the exercise were return of displaced personnel, political elections and unrest, multinational operations, and organized crime. The following table illustrates a few of the scenario themes and aviation mission critical tasks carried out during ATX VII.

Summary

At the end of each mission or operation, participants were debriefed in an after-action format. The feedback provided allowed for open discussion of critical issues and other possibilities of actions taken or ignored during the mission. It highlighted basic skills requirements needed to be successful with collective team training. This type of interaction for both ARI and other training units at Fort Rucker allowed the training and research organizations of the Army Aviation Center, a chance to gain valuable insight into the needs of FORSCOM units. The aviation community has lacked a collective training device that allows battalion and brigade level commanders to exercise and evaluate their staffs and key executors (i.e., instructor pilots and platoon leaders) without conducting a major live training event at one of the combat training centers. The network system described here has successfully demonstrated the capability to provide this type of collective training. This activity illustrates the value of combining research and training assets in the service of critical Army needs. The ability of ARI to observe mission rehearsal of actual FORSCOM units prior to real life deployments is a valuable opportunity. This opportunity gives RWARU the capacity to gain insights into the nature of the critical characteristics that simulators and networked tactical training systems need to possess in order to provide Army aviation units with the capacity to prepare for deployment to trouble spots worldwide.

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ATX VII Scenarios

Themes	Aviation Mission Critical Tasks
Resettlement/Returns	Conduct Hasty Attack (Lethal Response)
Rogue/Terrorist/Extremist Group Activities	Conduct Air Assault/Air Movement of MND Forces
Persons Indicted for War Crimes (PIFWC)	Conduct Reconnaissance Operations
Police Incidents	Conduct Security Operations (Show of Force)
Weapons Storage Site (WSS) Violations and Reductions	Apply ROE and GRM IAW TF Eagle (In-Country MND (N)) ROE/GRM
Training Violations	Perform Information Operations
Multi-National Specialized Unit	Implement Force Protection Measures
Aerial Response	Sustain the Force
Other (Elections, Albanian Kosovo Situation, etc.)	Battle Command

Cooperative Research Program to Develop Videogame Console Image Generator

The Rotary-Wing Aviation Research Unit (RWARU) at Fort Rucker, Alabama, has been examining the role that flight simulation should play in the training of Army helicopter pilots. Among the issues being dealt with in this research program, which is called Simulator-Based Aviator Training, is the cost of visual image generators, the component of flight simulators, which provide the crew with the visual scenes of the outside world. Throughout the history of flight simulators the means employed to provide these scenes has varied from mechanical camera devices with miniature models on huge boards to special-purpose computer systems designed to run specially constructed programs based upon massive databases of geographical information. Today as the speed and graphics capacities of personal computers have increased, so has the realism of visual imagery they can display. Perhaps nowhere has this capacity been as successfully exploited as in the videogame industry. While a number of games are operated in PCs, many are best rendered on devices known as videogame consoles. An emerging trend is to develop these, much lower cost, devices as tools for flight simulator visual image generation. In furtherance of this goal, RWARU has joined in a Cooperative Research and Development Agreement (CRDA) with a videogame software company, eGAD! Software to evaluate and develop high-end, console-based Image Generators (IG) to examine their value in helicopter flight and tactical training simulators. These non-proprietary, open-architecture IGs, originally developed to run Open Flight databases, are currently designed to run on game consoles.

Simulated aviation warfare will soon become even more realistic, as higher-resolution image generation products are emerging. These new technologies not only provide higher resolution, but also are being touted as significantly cheaper than current fielded products (nearly a third less per channel) and can migrate across a wide range of platforms.

eGAD! Software will integrate these videogame IGs onto various ARI RWARU simulators, using currently available databases and tools. The goal of integration is to refine requirements, design, and implement strategies that will greatly enhance simulation capabilities and provide more realism while significantly lowering the cost of high-fidelity flight trainers and other simulation environments.

The developed IGs will have features previously found only in the highest-end dedicated hardware. Software can migrate to new consoles as it's released. Potential statistics for the IGs are 33-75 million polygons per second at 15, 30, 60 or 85 Hz; sub pixel antialiasing; and physics-based environments: water, clouds, and dynamic terrain. eGAD! Software will license applications of its console-based core technology to military and civilian end-users.

eGAD! Software Background

eGAD! Software, located in San Diego, California, is an R&D engineering, programming, and marketing firm possessing knowledge and technical expertise in the video game and visual simulation / training markets. eGAD! Software develops high-end graphics image generation capabilities for PC and console platforms, which increases the ability to process polygons from 1.5 million polygons per second on current PC systems to greater than 43 million polygons per second in console-based platforms. This is accomplished through the production of a series of scalable IGs, Stealth Viewers (SV), and software toolsets that will be modular, re-configurable, and highly portable; support distributed and networked training systems as well as virtual, live, and constructive systems.

Additionally, eGAD! Software offers state-of-the-art graphics and animation design,

Harnessing the advantage and power now available with PC's to helicopter flight and tactical training simulators.

Cooperative Research Program to Develop Videogame Console Image Generator

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production knowledge capabilities, and special compositing effects combined with advanced stereovision that dramatically increase the realism of all interactive simulations environments through the creation of life-like avatars, scenes, terrain, and environmental effects. eGAD! Software also develops advanced compression schemes (250-300:1) that support the distribution of data through networked systems for simulations as well as Advanced Distributed Learning requirements.

Next Gen IG Systems

These next generations of IGs could well be a modification of high-fidelity game consoles commercially developed and procured as an off-the-shelf technological solution for image generation and database development. These new, very low-cost solutions can be networked for crew / team training or for mission rehearsal via Distributed Interactive Simulation (DIS) and High Level Architecture (HLA). These solutions seemingly present the Army with many, if not all, of the high-end appli-

cations and features provided on systems that cost millions of dollars. Some of the capabilities are listed in the table below.

In terms of capability, these platforms are being developed to utilize commercially available geo-specific databases (Open Flight), or DTED/DFAD/CIB importation, and offer some visual and database features not found anywhere else. In terms of speed and performance, these new console systems promise to rival many of the best systems available to the military today. These portended strengths are provided by companies such as Sony, Microsoft, and Nintendo, who are investing billions of dollars in what is being termed Console Polygonal Processing Graphics Engines (PlayStation, Xbox, Dolphin).

This cooperative arrangement between eGAD! and ARI carries the potential for vast improvements in the effectiveness of flight trainers and for large reductions in their cost. With reduced costs, the possibility for widespread application

Videogame Console IG Unique Features

(Features Usually Found Only In The Highest End IG; And Some Not Found Anywhere [Tentative])

- Full scene, subpixel antialiasing
- 30, 60, 85 Hz update rate
- True color
- Phong shading and lighting
- Bump mapping
- Large texture maps (1024x1024)
- Dynamic lighting and shadows
- Dynamic terrain
- Ownship lighting
- Z buffer and hybrid depth tools
- Synchronization lock between IGs

- 3D positional stereo audio from IG
- Bezier surfacing
- Physics-based environmental effects (flowing water, etc)
- 2,000 x 2,000 maximum resolution
- Flowing cloth tools
- Global/Localized weather
- 10 - 40 million polygons/second (166k - 666k/iteration)
- Real time manipulation of vertices (sea states which affect surface objects)

Cooperative Research Program to Develop Videogame Console Image Generator

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of flight simulation across a large number of units and task areas is increased.

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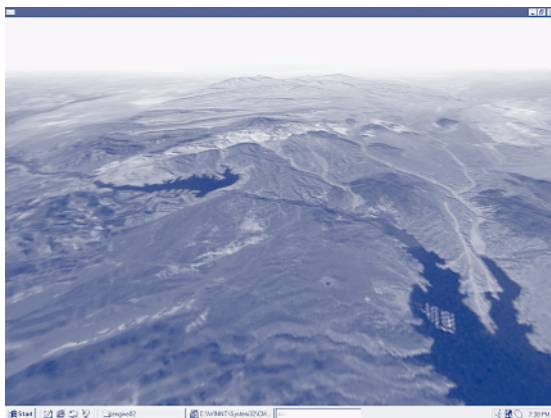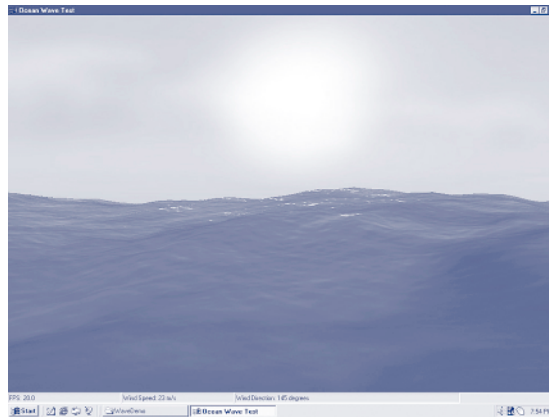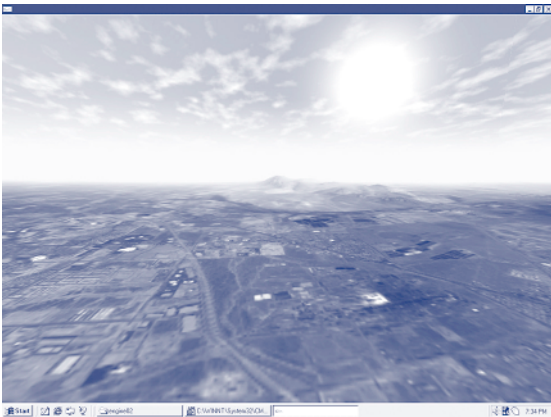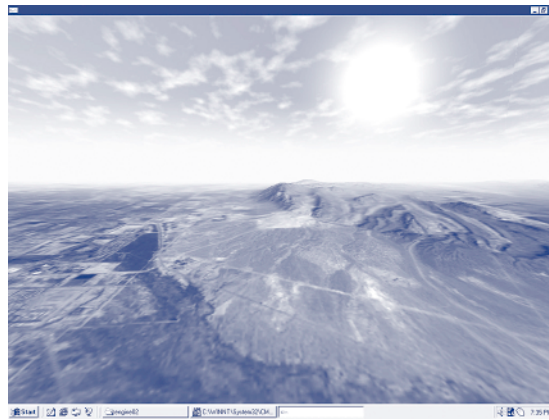
A Look at Army Attrition Losses During Initial Entry Training

Reasons for 1st term reductions and insights to better retention.

The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) has been conducting research to improve understanding of the causes of soldier attrition. Initial findings are based on attrition during initial entry training (IET). These findings point to the potential value of interventions targeted on medical/physical problems and soldier adaptation.

Research Background

Over the years, military research, study, and analysis have sought to identify why soldiers leave the Army. Altogether, these efforts have examined a variety of likely causal factors. However, attrition analysis has often concentrated on personnel factors (e.g., age, education credentials) for which data are readily available for analysis. Far fewer military efforts have looked at these individual factors in relationship to organizational factors, situational factors outside the military, or even individual characteristics that go beyond those traditionally tracked by personnel managers. Concentration on personnel indicators misses the opportunity to sharpen understanding of the organizational conditions that somehow relate to attrition. This concentration may also limit identification of the Army's actual capabilities to manage attrition by making internal organizational changes.

ARI developed its ongoing program of attrition research under the sponsorship of the Assistant Secretary of the Army for Manpower and Reserve Affairs (ASA)(M&RA)) and the Deputy Chief of Staff for Personnel (DCPSER), as agent for the Chief of Staff of the Army (CSA). This program is known as First Term Attrition and Management, or First Term for short. First Term is organized around two questions. First, how can the Army best account for attrition across the phases of the first term of enlistment (e.g., initial entry training, operational assignments)? Second, how can the Army impact the factors that drive attrition rates? The program's design also provided answers about the CSA's question concerning reasons for soldier attrition during IET.

To answer these questions, First Term has been investigating the soldiers who entered service during Fiscal Year 1999 (the FY99 Cohort). Central to the plans for First Term is tracking this cohort over the full course of the first enlistment term. Like other efforts, First Term makes use of existing Army data files on the personnel characteristics, career histories, and retention of soldiers. First Term also uses a number of other methods to broaden the scope and included organizational and extra-organizational factors. These methods include survey of the FY99 soldiers, with question-naires administered at several periods over the course of the initial enlistment. Data from the several sources will be combined to model attrition and to derive and assess best-bet attrition management interventions.

Findings on IET Attrition

Because First Term covers the full enlistment term of the FY99 Cohort, answers about attrition become available as these soldiers progress through the term. Thus, the infor-mation available now concerns IET, the early portion of the term. This information is also responsive to the CSA's question about the reasons for IET attrition.

Figure 1 shows findings from the exit question-naire taken by the FY99 soldiers who attrited from the Army while in IET. This questionnaire was completed by about 64% of the FY99 IET soldiers attriting service during the period of January - December 1999. In taking the ques-tionnaire, soldiers described in their own words why they were leaving the Army. Figure 1 shows the major categories into which the reasons were placed; it also displays the percents of soldiers giving reasons in each category.

In looking at Figure 1, no one is likely surprised by either the categories or the percent per category. By far, the two largest categories of reasons involved either a medical/physical condition or adjustment to Army life. Indeed, these two categories accounted for over 70% of

A Look at Army Attrition Losses During Initial Entry Training

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the attriting soldier's self-reported reasons.

The smallest category involved treatment by the Army. Most of the responses in this treatment category (3.4%)[1] were general in nature and simply indicated "poor or unfair treatment", without giving further explanation. The numbers giving more precise indications were spread across such sub-categories as "misled" (1.6%), "poor medical care" (.4%), "poor leadership" (.3%), and "discrimination" (.2%). Any report of mistreatment merits attention; it might cue corrective actions that, if taken, prevent harm to soldiers and ultimately to the Army (e.g., a personnel loss). In this case, the relatively small percents citing specific forms is noteworthy, especially considering that attrition represents disappointment with respect to the enlistment term both to the separating soldiers and to the Army.

The complexity of the reasons for IET attrition was shown when self-reported reasons were compared with the official reasons (separation codes) recorded by the Army. Of the soldiers officially separated for medical reasons, a large majority themselves reported medical-physical conditions as reasons for leaving. Most soldiers officially separated for dependency/hardship cited reasons consistent with the official discharge; that is, most cited an outside influence (e.g., family problems, outside job opportunities) as contributing factors. The self-reports of soldiers officially separated under the voluntary discharge program or for a failure to meet behavioral/performance standards were spread across the five categories in Figure 1, but these reports most frequently cited reasons concerning adjustment to Army life or outside influences.

The exit survey also sought information about ways for reducing attrition. The separating soldiers, for example, rated the extent to which selected methods (e.g., accurate medical information; respect for recruits) might have
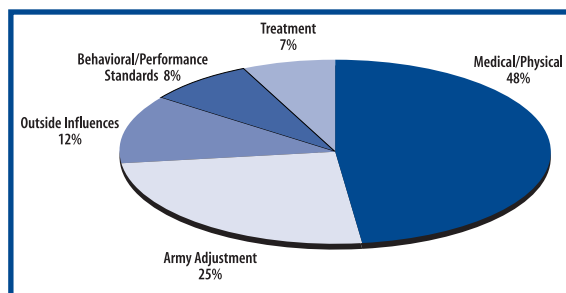

Treatment 7%
Behavioral/Performance Standards 8%
Outside Influences 12%
Medical/Physical 48%
Army Adjustment 25%

Figure 1: Self-Reported Reasons for IET Attrition

helped them stay in the Army. By far, "realistic descriptions of Army life before entry" received the strongest endorsement by the separating soldiers. Other data indicated that the previews might serve the Army well by highlighting the importance of medical conditions and good health for successful completion of IET. Other data suggested that the Army could also benefit by obtaining reciprocal information from new soldiers about their medical histories. Such self-reports given at entry were found to differentiate soldiers that later did and did not attrit.

Summary

This article summarizes initial findings of ARI's program of research on first-term enlisted attrition. The full meaning of implications will become clearer over the course of the program. Over this course, the First Term data will capture more completely the context of the organizational, environmental, and career development factors that influence attrition and continuance behavior. The data on IET attrition do point to interventions on medical/physical problems and soldier adaptation for gains in attrition management. One such intervention would involve Army practices. The intervention would consist of "two-way" previews between new soldiers and the "Army". The previews would provide new soldiers with realistic information about Army life. The previews would also produce information from soldiers about attrition risks (e.g., past medical history) useful to leaders in adapting Army experiences to individual soldiers.

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[1] All percents in this paragraph are percents of the 3,759 attriting soldiers whose exit reasons could be placed into one of the 24 sub-categories under the five major categories in Figure 1.

New Test To Predict Attrition

New test for recruits that incorporates resistance to faking and without an adverse effect to minorities will be implemented in a pilot program for expanding the recruiting market.

A new ARI test has contributed to an Army recruiting and selection strategy for responding to the difficult recruiting environment. The history of this new measure, AIM, begins in the 1980s with research showing the importance of motivational attributes in the prediction of first-term attrition and duty performance. Positive findings from ARI's AIM research program have led to its operational use in an innovative Army recruiting-market expansion program.

Development of AIM
In the 1980's, the Army developed a self-report measure of motivational attributes called the Assessment of Background and Life Experiences (ABLE). It was shown to forecast first-term attrition and duty performance. Importantly, ABLE was shown to provide unique information about an individual's motivation that is not captured in the Army's current personnel screening system.

These results generated much interest, but ABLE was never used for pre-enlistment screening due to concern about its susceptibility to faking and coaching. It allowed respondents to raise their scores by presenting themselves as better than they really are; that is, faking "good." Later ARI research eventually confirmed that high levels of score inflation that result from faking do indeed undermine the effectiveness (i.e., validity) of ABLE for predicting attrition and duty performance. For this reason, the operational use of ABLE in Army pre-enlistment screening is no longer being considered.

In response to this limitation, ARI recently developed a new faking-resistant measure of ABLE attributes. This measure is called the Assessment of Individual Motivation (AIM). AIM is a self-report, paper-and-pencil test that requires 30 minutes to administer. It reliably measures examinees' Dependability, Adjustment, Dominance, Achievement Orientation,

Agreeableness and Physical Conditioning. As with ABLE, recruits with low AIM scores were shown to be at high risk for failing to complete initial entry training. In addition, those scoring high (as compared to low) on the AIM reported greater confidence in their ability to adjust to military life and perform well in the Army. Those with higher AIM scores also reported more satisfaction with their decision to join the Army, and greater commitment to serve and complete their obligated term of service.

AIM Pre-Implementation Research Program: 1998 - 1999
Under the sponsorship of LTG Vollrath, former Deputy Chief of Staff for Personnel, ARI began its AIM Pre-Implementation Research Program in 1998. The primary goal of this contract effort was to establish whether the operational use of AIM for managing attrition would be viable for the Army. This critical assessment would require the testing of many more Army recruits on AIM than have been tested prior to the program. Army recruits were tested on AIM on an ongoing basis at all six Army Reception Battalions from September 1998 - May 1999. A total of over 25,000 Regular Army soldiers were tested during this period. A sample of these soldiers was tracked to determine their 3-, 6-, and 9-month attrition status. This enabled ARI to assess how well AIM predicts first-term attrition.

AIM Midcourse Assessment. In February of 1999, ARI reached the Mid-Course Assessment phase of its AIM Pre-Implementation Research program. A 5-member panel of testing experts conducted a careful external review of the initial findings. Based on their review, the panel recommended that the Army proceed with an Initial Test and Evaluation of AIM.

Later Research Findings Were Highly Encouraging. By the end of the AIM Pre-Implementation program (December 1999),

New Test To Predict Attrition

Continued from previous page

3-month attrition data were available for over 14,500 trainee soldiers who were tested on AIM from September 1998 through March 1999. By linking trainees' test scores to their attrition status, it became possible to assess how well AIM scores relate to early attrition. This relationship is shown in Figure 1. In the figure, trainees are rank-ordered on their AIM scores according to deciles. For example, those falling in the lowest 10% on AIM are assigned to decile 1, while those scoring among the highest 10% on AIM are assigned to decile 10. As shown in the figure, AIM scores are clearly related to trainee attrition, with those in the lowest decile having an attrition rate that is more than 3 times greater than those in the highest decile (19% vs. 6%). Clearly, Army recruits with low AIM scores are at the highest attrition risk.

As a part of AIM's assessment, we also examined its relationship with trainee attrition among a larger sample of airmen who were tested (at the beginning of Basic Military Training) in FY98. The relationship between AIM and 3-, 6-, and 9-month attrition in this U.S. Air Force sample was very similar to the one depicted for our Army sample, shown in Figure 1. In addition, the Army and Air Force findings with AIM are highly consistent with past ARI research conducted using the ABLE. Since AIM was developed to measure the same job-related attributes as ABLE, we would expect AIM and ABLE to perform in a similar manner.

Our research findings also showed that AIM provides unique added value to the Army's current personnel assessment system. When it comes to predicting attrition, its predictive power goes above and beyond the measures currently used for selecting applicants (i.e., educational attainment and Armed Forces Qualification Test scores).

Figure 1: Relationship Between AIM and 3-Month Attrition:
Low AIM Scores Indicate High Attrition Risk
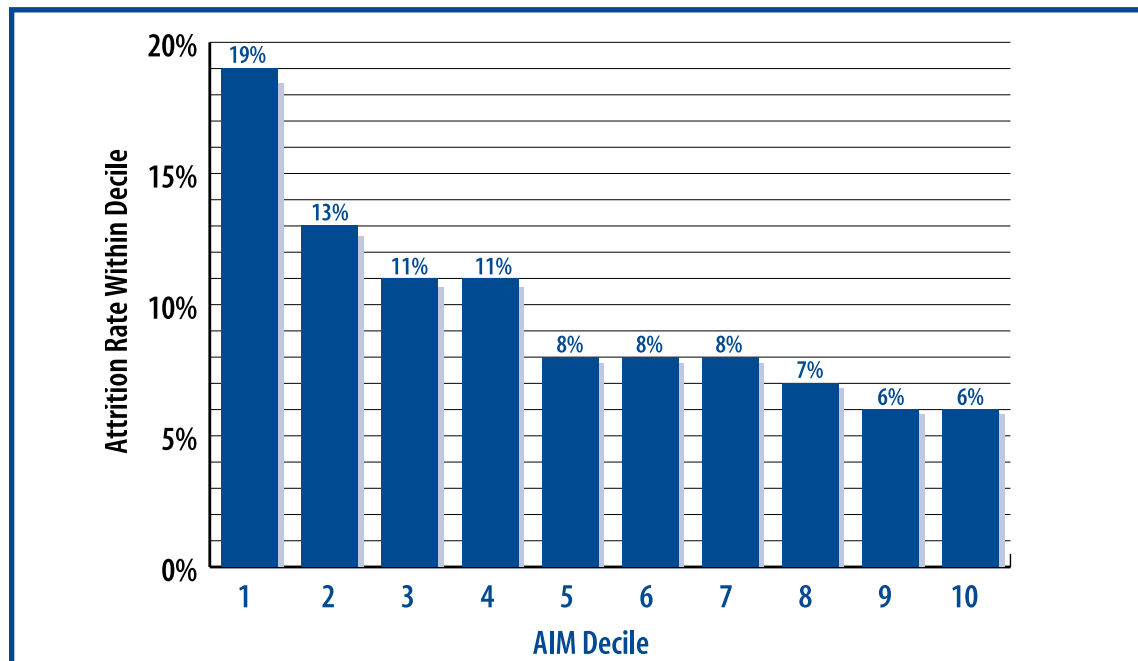
New Test To Predict Attrition

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Results of the AIM Pre-Implementation Research Program also indicate that unlike ABLE, AIM is highly resistant to faking. Very little score inflation was observed when subjects in a faking experiment were encouraged to raise their scores on AIM. These findings suggest that AIM may be well suited for use in operational conditions – such as pre-enlistment screening – where applicants would be highly motivated to fake in order to raise their scores.

One important concern when introducing any new screening test is to ensure that its use does not result in adverse impact for women or minorities. This concern was directly addressed in our assessment of AIM, and we found no evidence that AIM screening would lead to adverse impact among these groups.

In sum, the research findings from ARI's research program suggested that AIM would be a viable pre-enlistment screening tool. It reliably predicts attrition, while providing unique information not captured by the Army's current personnel assessment measures. Importantly, AIM resists faking, and is unlikely to create adverse impact against woman or minorities.

Current Status of AIM

As a result of the encouraging findings, the Army leadership has decided to implement AIM as one component of a new experimental pilot program for expanding the recruiting market. Candidates for the program are being tested on AIM at Military Entrance Processing Stations (MEPS) through September 30, 2003. Those accepted under this new recruiting initiative will be sponsored to complete an attendance-based General Education Development (GED) program while serving in the Army's Delayed Entry Program. Those already possessing a GED will qualify for special enlistment incentives. This new experimental program, "GED Plus – the Army's High School Completion Program," was publicly announced and initiated on February 3, 2000.

Under the GED Plus program, the Army plans to access up to 6,000 youth each fiscal year. As of June 2000, over 2,000 new recruits have been accepted into the program, and about 1,500 of these recruits have already entered onto active duty.

For additional information, please contact Dr. Mark Young, DSN 767-0334 or Commercial (703) 617-0334; or Dr. Michael Rumsey, DSN 767-8275 or Commercial (703) 617-8275, ARI - Selection and Assignment Research Unit. Youngm@ari.army.mil or Rumsey@ari.army.mil.

Force Modernization and the Live Training Domain

The U.S. Army Training Modernization Directorate (ATMD) is responsible for defining live training support requirements for homestations and maneuver combat training centers (MCTCs). ATMD envisioned the need for a series of behavioral and technical studies to help address the impacts of new weapon systems, digital systems, and reconnaissance, surveillance and target acquisition (RSTA) systems being fielded under the rubric of force modernization. ARI was asked to perform six behavioral studies, beginning with the 1997 Training Analysis and Feedback Aids (TAAF Aids) study. ATMD was concerned that modernization, in the absence of training support interventions, would have the unintended consequence of inundating trainers with new requirements to a point where exercise realism and the quality of feedback would suffer.

The TAAF Aids study examined 140 new and emerging weapon, digital and RSTA systems to identify their impacts on observer/controllers (OCs) and analysts for live force-on-force exercise at the MCTCs. Our objective was to find out what OCs and analysts would need to do to help support the simulation of new systems and provide units with feedback regarding system employment. We first identified the elements of intrinsic feedback needed to cue and guide unit employment of systems during exercises as well as those elements of extrinsic feedback needed to support post exercise after action reviews (AARs). Next we identified the likely sources of feedback in the absence of any major improvements in tactical engagement simulation (TES) or instrumentation systems (i.e., interactions with other soldiers and actual operational equipment, TES/instrumentation, trainers, or no feedback source). For those cases where it appeared that OCs and analysts would be the source of feedback we described the work to be done by the OC and/or analyst. Figures 1 and 2 provide an example of the results of

this analytical process for intrinsic feedback regarding Apache Longbow Hellfire non-line-of-sight engagements. The impact of this system alone can be better appreciated by considering that the helicopter crew being observed by an aviation OC is capable of firing multiple missions concurrently, and an aviation analyst is likely to support many aviation OCs.

The TAAF Aids study also included a description of the functions performed by OCs and analysts in preparing AAR aids. These are functions that must be performed regardless of the specific weapon, RSTA, and digital systems employed.

The TAAF Aids study concluded that OCs and analysts would be overwhelmed by new exercise control and feedback requirements, in the absence of intervention. Many of the new "non-lethal," "smart" or "non-line-of-sight" weapons require substantial work to support the simulation of weapons effects. RSTA systems, on the other hand, impose heavy observation and data collection requirements. Digitization has the effect of pulling trainers at platoon and company level out of the information loop, while command and staff trainers

> *Determinates for new generation observer/ controllers digital and weapons systems analysis and feedback.*

O - Visual/audible indication of hit
Visual/audible indication of vehicle status:
    O - Fully operational
    O - Catastrophic kill
    O - Mobility kill
    O - Firepower kill
    O - Communications kill
    P - Type combat damage
N - Missile trajectory
N - Visual/audible indication of all misses

P - Visual means to ID friendly and enemy
T - Visual signature when weapon fires
O - Aircraft survivability equipment on or off
N - Audible signature when weapon fires
N - Missile trajectory

N = No Feedback
T = TES Feedback
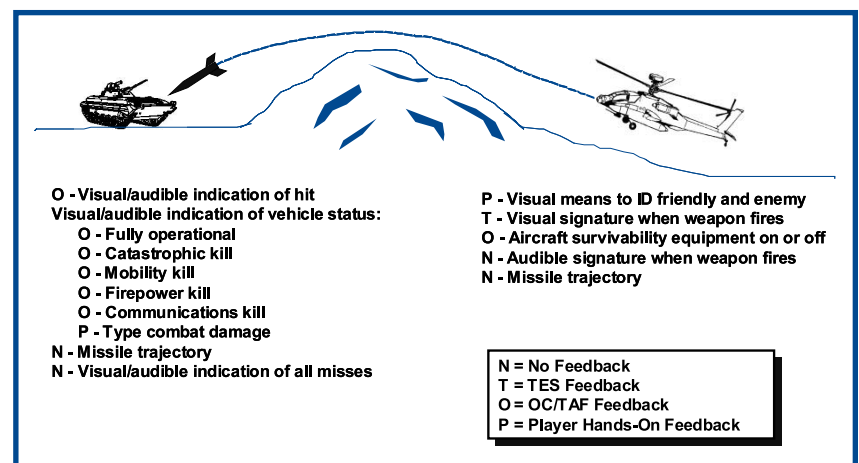O = OC/TAF Feedback
P = Player Hands-On Feedback

Figure 1: Elements of intrinsic feedback and feedback sources needed to cue and guide weapon employment.

Force Modernization and the Live Training Domain

AVN Analyst
1. Receive shooter ID and target location from AVN OC
2. Receive information on player use of aircraft survivability equipment from OC
3. Plot target location
4. Plot missile(s) footprint
5. If entities within footprint, assess battle damage according to PK
6. Administratively kill entity from TAF facility
7. Inform OPFOR that AH-64D Longbow Hellfire killed the vehicle

AVN OC
1. Coordinate and monitor shooter procedures to engage target
2. Record and inform TAF analyst if aircraft survivability equipment on or off
3. Record target description and location
4. If procedures valid, forward shooter and target information to AVN analyst
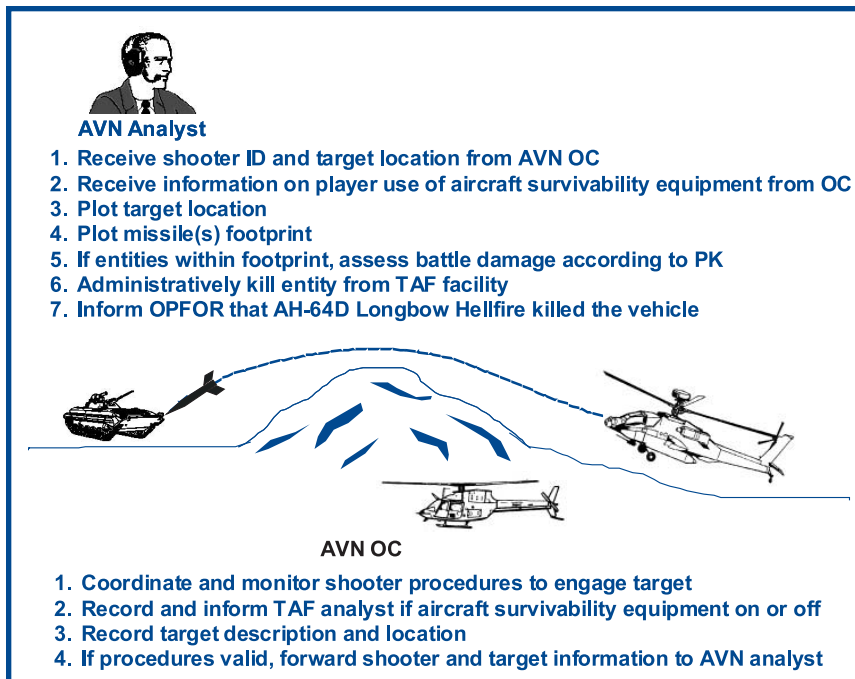
Figure 2: Work performed by aviation OCs and analysts to provide cues for weapon employment.

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are overwhelmed with new data collection requirements. The study also identified 25 functions performed by OCs and 86 functions performed by analysts in preparing AAR aids. These functions are performed manually for the most part.

In 1998, we performed three integrated studies to help address problems identified in the TAAF Aids Study (see Figure 3). The Advanced TES Concepts (ATESC) Study describes fourteen high level TES concepts to reduce the work associated with weapon and RSTA systems and to fill potential gaps in feedback regarding employment of these systems. The Cognitive Requirements for Information Operations Training (CRIOT) Study describes twenty capabilities a workstation needs to support exercise control and feedback activities associated with digital systems. The Advanced AAR Media (A3RM)

Study describes shortfalls in the ability of instrumentation to support AARs and described concepts for AAR systems that automate the AAR preparation and delivery process. The A3RM study used input from the ATESC and CRIOT studies.

In 1999 two additional studies were performed. The first study, Training Analysis and Feedback Center of Excellence (TAAF-X), continued the previous line of work by examining the feasibility of using a centralized analysis facility to support training at multiple MCTC or homestation sites concurrently. Implementation of the TAAF-X concept is enabled by implementing proposals from the ATESC, CRIOT and A3RM studies to make sure the Army has the electronic data stream and tools needed to automate AAR aid preparation activities.

The second study performed in 1999, Live Fire Futures (LFF), explored the benefits of live fire training and examined the impacts of force modernization and asymmetric battlefield tactics on live fire training exercises and training strategies. Identifying and avoiding situations that can result in fratricides is a major part of the job of trainers for live fire exercises, and the future battlefield complicates the performance of this job task. Force modernization makes it possible for units to engage targets at longer ranges with a smaller planning and preparation turn around time. At the same time, digitization makes it more difficult for trainers at platoon and company level to track intended unit actions, and the asymmetric battlefield increases the possibility that friendly or neutral forces will be interspersed among enemy forces. New tools are needed to help OCs and analysts monitor and control live fire exercises at crew level and above.

Force Modernization and the Live Training Domain

Training Analysis and Feedback
Aids (TAAF-Aids)

Documented AAR preparation and delivery tasks

Impacts of digital systems
on data collection and
exercise control tasks

Impacts of new weapon
and RSTA systems on data
collection and exercise
control tasks:

Advanced AAR
Media (A3RM)

Cognitive Requirements
for Information Operations
Training (CRIOT)

Advanced Tactical
Engagement Simulation
Concepts (ATESC)

Concepts for applying automation to decrease AAR preparation workload

Concepts for displays of
digital information that
support exercise control,
data collection, and AARs

Concepts for applying
automation to reduce data
collection and exercise control
tasks and database for
assessing benefits of
implementing new TES
concepts

Training Analysis and
Feedback Center of
Excellence (TAAF-X)

CRIOT and ATESC set the stage for implementing
A3RM and TAAF-X concepts

Benefits and feasibility of using centralized analysis facilities for AAR preparation

Extrinsic Feedback
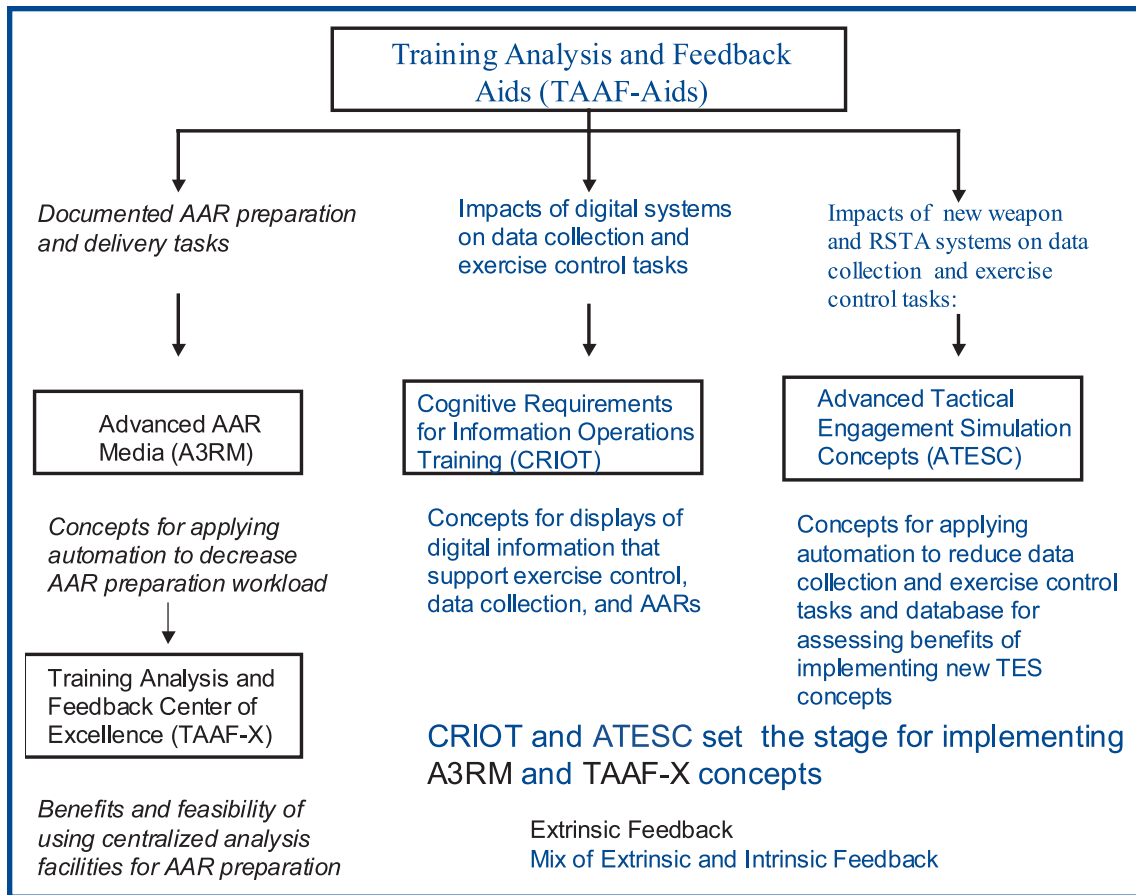Mix of Extrinsic and Intrinsic Feedback

Figure 3. Relationships among live training support studies.

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All six studies provide input to ongoing U.S. Army Simulation, Training and Instrumentation Command (STRICOM) efforts to identify and address requirements for MCTC and homestation objective instrumentation systems that apply automation to reduce OC and analyst workloads. In addition, the ATESC study provides input to current Army efforts to develop a new generation of TES systems. Finally, the CRIOT and A3RM studies provide input for integrating unit digital systems with current and future training instrumentation systems for live, virtual and constructive domains.

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